

※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

**Multiple Choices (There might be one or more choices in each question. You will get 5% for each question only if all your choices are correct)**

1. Which of the following statements are true?

- (A) MTTF (Mean Time To Failure) is a commonly used reliability metric for hard drive
- (B) Rotation latency is the required time for the desired sector of a hard disk to rotate under the read/write head.
- (C) Using RAID 0 allow higher performance than a single disk
- (D) Instead of storing a complete copy of the original data for each disk, RAID 3 only adds enough redundant information to restore the lost information on a failure.
- (E) None of the above

2. Which of the following statements are true?

- (A) TCP/IP is a commonly used transport layer protocol
- (B) HTTP is a session layer protocol
- (C) OSI reference model has 5 layers
- (D) CSMA/CD is widely used in local area network
- (E) None of the above

3. Which of the following statements are true?

- (A) Synchronous bus uses a handshaking protocol for coordinating usage rather than a clock
- (B) Backplane bus allows processors, memory, and I/O devices to coexist on a single bus
- (C) Firewire and USB 2.0 use asynchronous bus
- (D) By using DMA controller, bus can be released during a bus transaction while the requester is waiting for the data to be transmitted, which frees the bus for access by another requester.
- (E) None of the above

4. Which of the following statements are true?

- (A) Quantum computer can solve all NP-complete problems in polynomial time
- (B) Currently, there is no quantum computer hardware available to do any quantum computing task
- (C) Quantum computer could efficiently decipher security codes that are generated by classical integer factorization
- (D) Quantum computer could apply principles of quantum mechanics to achieve higher CPU clock rate
- (E) None of the above

5. Assume a processor has a clock rate of 500 MHz and an ideal CPI (no memory misses) of 1.0. What is the effective

CPI if a program with a mix of 50% arithmetic and logic, 30% load/stores and 20% control instructions is run, if 10% of the data memory operations and 1% of the instructions have a miss penalty of 50 cycles.

- (A) 1
- (B) 2

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(C) 3

(D) 4

(E) None of the above

6. Suppose we have a deeply pipelined processor, for which we implement a branch-target buffer for the conditional branches, which are 15% of the instructions. Assume that the mis-prediction penalty is always 3 cycles and the buffer miss penalty is always 6 cycles. Assume 90% hit rate in the buffer and 75% accuracy of the buffer prediction. Assume a base CPI without branch stalls of 1. What is the CPI?

(A) 1

(B) 1.09

(C) 1.19

(D) 1.675

(E) None of the above

7. A memory system has 1M words. Each word is an 8-bit byte. The memory is organized into blocks of 8 words each. The cache has 256K words, organized into cache lines of 8 words each. The memory cache is organized into 4-way set associative cache.

(A) 13 bits are needed for cache set address.

(B) 4 bits are for Tag

(C) 21 bits are needed to address all words

(D) 17 bits are needed to address all blocks

(E) None of the above

8. A hard disk has a track seek time of 10ms. The disk rotation speed is 9000 rpm. Each track on the disk has 600 sectors. Each sector has total 512 bytes data. What is the average time it takes to read 1024 bytes data?

(A) 10.5 ms

(B) 13.355 ms

(C) 14.55 ms

(D) 15.333 ms

(E) None of the above

9. Which of the following statements are true?

(A) In floating point number, the binary point is not fixed

(B) Units in the last place (ulp) is the number of bits in error in the most significant bits of the significand between the actual number and the number that can be represented.

(C) When a negative exponent of a floating point number becomes too large to fit in the exponent field, underflow occurs.

(D) In floating-point addition, before addition of the significands, the decimal point of the number that has the smaller

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exponent should be aligned.

(E) None of the above

10. Which of the following statements are true?

(A) If the data requested by a load instruction has not yet become available when it is requested, the load-use data hazard occurs.

(B) Data hazard may be resolved with bypassing technique which retrieve the hitting data element from internal buffers rather than waiting for it to arrive from external memory.

(C) If the proper instruction cannot execute in the proper clock cycle because the instruction that was fetched is not the one that is needed, the data hazard occurs.

(D) Delayed branch is used to solve control hazard. The delayed branch always executes the next sequential instruction, with the branch taking place after that one instruction delay.

(E) None of the above

11. Assume that we have a memory management system with TLB (Translation-Lookaside Buffer). Assume that each memory access uses  $x$  microsecond, each TLB lookup uses  $y$  nanosecond, and the hit ratio is  $z$ . Which of the following statements are true?

(A) If  $x$  is 1 us (microsecond),  $y$  is 1 ns (nanosecond), and  $z$  is 95%, the effective memory access time (EAT) is 1.041 us.

(B) If  $x$  is 1 us,  $y$  is 2 ns, and  $z$  is 98%, the EAT is 1.022 us.

(C) If  $x$  is 2 us,  $y$  is 1 ns, and  $z$  is 99.8%, the EAT is 2.005 us.

(D) If  $x$  is 1 us,  $y$  is 1 ns, and  $z$  is 99.9%, the EAT is 1.012 us.

(E) If  $x$  is 3 us,  $y$  is 15 ns, and  $z$  is 99%, the EAT is 3.045 us.

12. Assume that we have a memory management system with TLB (Translation-Lookaside Buffer) and  $n$ -level paging.

Assume that each memory access uses  $x$  microsecond, each TLB lookup uses  $y$  nanosecond, and the hit ratio is  $z$ .

Which of the following statements are true?

(A) If  $n$  is 3,  $x$  is 2 us,  $y$  is 10 ns, and  $z$  is 96%, the EAT is 2.25 us.

(B) If  $n$  is 4,  $x$  is 1 us,  $y$  is 20 ns, and  $z$  is 98%, the EAT is 1.02 us.

(C) If  $n$  is 2,  $x$  is 2 us,  $y$  is 12 ns, and  $z$  is 99.8%, the EAT is 2.02 us.

(D) If  $n$  is 6,  $x$  is 1 us,  $y$  is 14 ns, and  $z$  is 99.9%, the EAT is 1.012 us.

(E) If  $n$  is 5,  $x$  is 2 us,  $y$  is 18 ns, and  $z$  is 99%, the EAT is 2.11 us.

13. Which of the following are necessary conditions of deadlock ?

(A) There exists a set  $\{P_0, P_1, \dots, P_n\}$  of waiting processes such that  $P_0$  is waiting for a resource that is held by  $P_1$ ,  $P_1$  is waiting for a resource that is held by  $P_2$ , ...,  $P_{n-1}$  is waiting for a resource that is held by  $P_n$ , and  $P_0$  is waiting for a resource that is held by  $P_0$ .

(B) A process holds at least one resource is waiting to acquire additional resources held by other processes.

(C) A resource can be released only voluntarily by the process holding it, after that process has completed its task.

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(D) OS cannot kill a process to reclaim the resources held by that process.

(E) Only one process at a time can use a resource.

14. Assume that we use Banker's algorithm to avoid deadlocks. There are five processes  $P_0, P_1, P_2, P_3,$  and  $P_4$ . There are also three resource types, A, B, and C. There are 10 instances of type A resources, 5 instances of type B resources, and 7 instances of type C resources. The maximum requirements for the three resource types for the processes are as follows.

	A	B	C
$P_0$	7	5	2
$P_1$	4	2	2
$P_2$	6	0	2
$P_3$	2	2	3
$P_4$	4	3	3

Which of the following snapshots of allocation status are safe ?

(A)	A	B	C	(B)	A	B	C	(C)	A	B	C	(D)	A	B	C	(E)	A	B	C
$P_0$	0	1	0	$P_0$	0	1	0	$P_0$	0	1	1	$P_0$	0	1	0	$P_0$	0	1	0
$P_1$	2	0	0	$P_1$	4	0	0	$P_1$	2	0	0	$P_1$	1	0	2	$P_1$	2	2	0
$P_2$	3	0	2	$P_2$	3	0	2	$P_2$	1	0	2	$P_2$	4	0	2	$P_2$	3	0	2
$P_3$	2	1	1	$P_3$	2	1	0	$P_3$	2	1	1	$P_3$	2	1	1	$P_3$	2	0	1
$P_4$	0	1	2	$P_4$	0	0	2	$P_4$	0	0	2	$P_4$	0	0	2	$P_4$	0	0	2

15. We have the following 5 processes.

Process	Arrival time	Burst time
P0	0	5 ms
P1	1	2 ms
P2	3	7 ms
P3	6	6 ms
P4	7	5 ms

Which of the following statements are true ?

- (A) With First-Come First-Serve CPU scheduling policy, the average response time is 5.8ms.
- (B) With non-preemptive short-job-first CPU scheduling policy, the average response time is 5ms.
- (C) With preemptive short-job-first CPU scheduling policy, the average response time is 4.2ms.
- (D) With round-robin CPU scheduling policy with quantum size = 3ms, the average response time is 2.8ms.
- (E) With round-robin CPU scheduling policy with quantum size = 4ms, the average response time is 3.8ms.

16. Assume that we have a disk with tracks indexed from 0 to 99. Assume that now the disk head at track 50 moving toward track 51. Now we have the following request queue of accesses to tracks 7, 87, 32, 67. Which of the following statements are true.

- (A) With first-come first-serve disk scheduling policy, the distance of head movement is 89.
- (B) With the SCAN disk scheduling policy, the distance of head movement is 143.

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- (C) With the C-SCAN disk scheduling policy, the distance of head movement is 180.  
(D) With LOOK disk scheduling policy, the distance of head movement is 141.  
(E) With C-LOOK disk scheduling policy, the distance of head movement is 142.
17. Which of the following statements about disk arrays are true ?  
(A) RAID 1 is basically mirrored disks.  
(B) RAID 2 is with memory-style error-correcting codes.  
(C) RAID 3 is with block-interleaved parity error-detecting codes.  
(D) RAID 4 is with bit-interleaved parity error-detecting codes.  
(E) RAID 5 is with bit-interleaved distributed parity error-detecting codes.
18. About bootstrap programs, which of the following are true ?  
(A) They are usually stored in ROM or EEPROM.  
(B) They are generally known as firmware.  
(C) They initialize a computer.  
(D) They check if new versions of operating system kernel are available.  
(E) They load operating systems and start execution.
19. In the management of transactions, we adopt the following notations. Operations in a schedule are executed from left to right.  $R_k(X)$  means a read operation to object X by transaction k.  $W_k(X)$  means a write operation to object X by transaction k. Which of the following schedules are serializable ?  
(A)  $R_1(A)R_2(B)W_1(A)W_2(B)$   
(B)  $R_1(A)W_2(A)W_1(B)R_2(B)$   
(C)  $R_1(A)W_2(B)R_1(B)W_2(A)$   
(D)  $R_1(A)R_2(B)W_1(B)W_2(B)$   
(E)  $W_1(A)R_2(A)W_2(B)R_1(B)$
20. Assume that we are with a virtual memory of 4 physical frames. The page reference sequence is 1 4 3 2 1 3 3 5. When there is a conflict in selecting a page for replacement, we select the page with smaller index. Which of the following statements are true after the execution of the sequence ?  
(A) With the LRU page-replacement policy, the four pages in the physical memory are 2, 3, 4, and 5.  
(B) With 3 additional reference bits per page for the approximation of the LRU policy, the four pages in the physical memory are 1, 2, 4, and 5. Assume that one bit is shifted for all frames after each access.  
(C) With the second-chance algorithm, the four pages in the physical memory are 1, 2, 3, and 5.  
(D) With the least-frequently-used (LFU) algorithm, the four pages in the physical memory are 1, 3, 4, 5.  
(E) With the most-frequently-used (MFU) algorithm, the four pages in the physical memory are 2, 3, 4, 5.